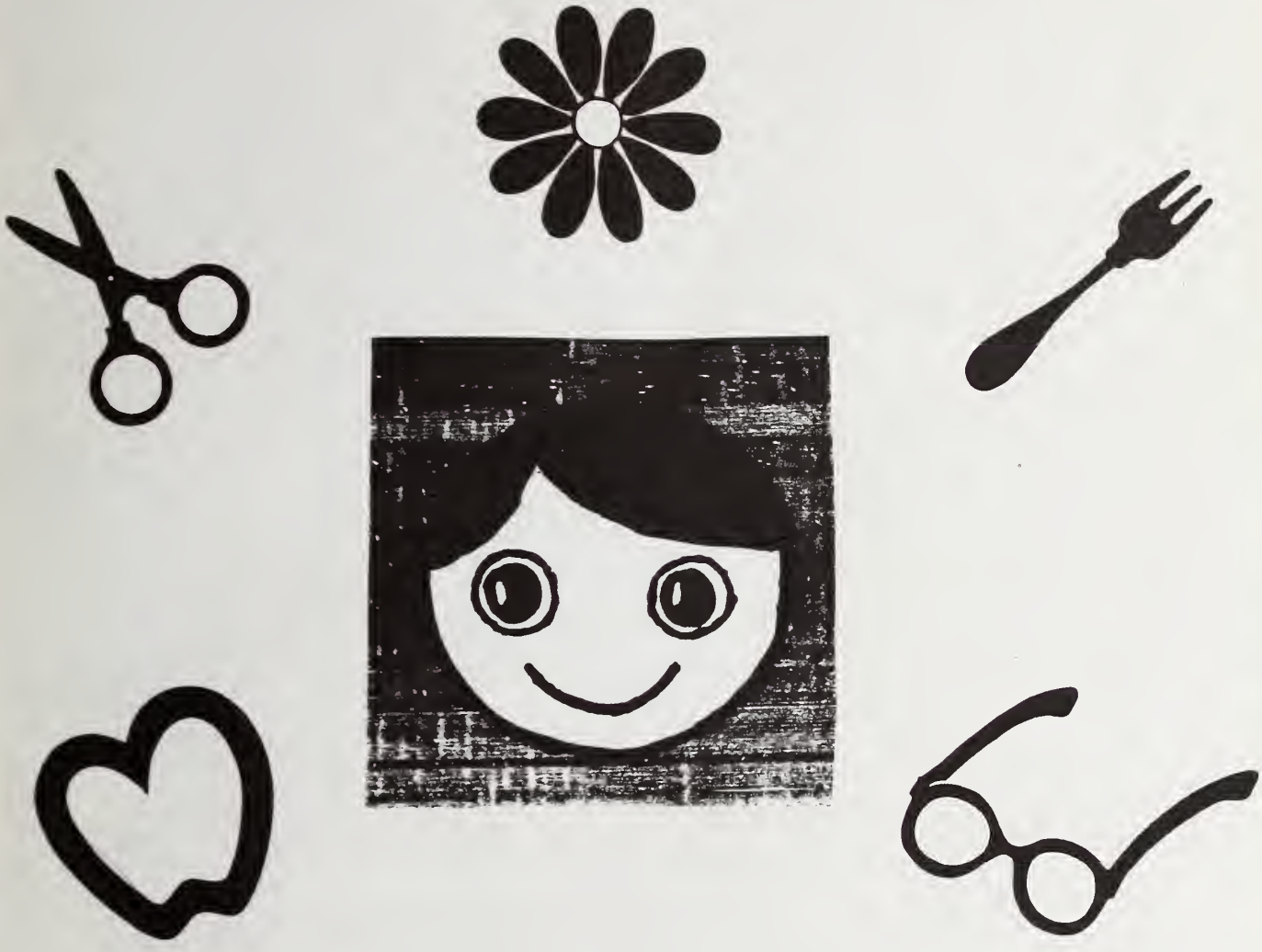
HOW WELL does a CHILD SEE?



a guide

for parents, attendants, teachers

by

EVA LINDSTEDT

Vision assessment and preparations for testing children's vision. A guide for parents, attendants and teachers

Eva Lindstedt

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I The development and practical importance of vision

Seeing and its utilisation are very much based on the proper utilisation of visual impressions by the brain. These impressions have to be combined with impressions from other senses, linked up with motor functions (movements of the head, body, eye and hand) and processed conceptually and emotionally. A retarded child often has an additional disability which affects these processes, e.g. disturbances affecting perception, motor skills and emotional development. This may be due to various degrees of developmental disturbance or brain damage and perhaps to the disruptions of the early mother-child relationship which inevitably occur if the child is born prematurely, is in bad condition at birth or does not respond normally to the mother's care and attention.

One is often at a loss to know the exact degree of a child's visual handicap. Perhaps it is uncertain whether the child can see at all. Sometimes one knows that the child can see but is uncertain of his exact visual capacity. This causes hesitancy when dealing with the child. How is one to stimulate vision when it is low or undeveloped?

If the child fails to make any progress, one wonders what the reason can be. Is the play material too difficult in visual terms? Does it make excessive mental demands? Is it the interpretation of visual impressions, i.e. visual perception, which is disturbed in spite of normal visual acuity? Is vision blocked by mental screening?

Other questions also arise. How long are we to persist in our attempts at stimulation, how long can we go on hoping that vision will "get started"? How vigorously are we to train the child? This last question is, not least, psychologically important both to the child and to his parents.

The thing is to help the child achieve the best possible total development. Vision is an important instrument in the child's development, but if his vision is very low, undue emphasis on vision may do more harm than good. Something has to be known about the child's visual capacity if mistakes are to be avoided.

It is difficult to assess and test the vision of a small child in cases where vision is low, and especially if the child is also retarded. In most

cases, however, vision can be appraised, so long as the right procedure is employed. Examination methods must be adapted to the child's developmental level and disability and the examination must also have a clearly defined purpose. Ordinary vision testing methods are mainly intended for adults and children whose development is relatively normal in various respects, and they have been defined for particular purposes, e.g. guidance for testing glasses. Neither the circumstances nor the purpose of vision testing are the same when we wish to investigate the vision of a small or multiply handicapped child.

What is the function of vision in the small child?

A newborn receives a host of impressions through its various senses. An infant has an innate capacity for receiving and, to some extent, processing these impressions. They support the child's capacity for achieving self-awareness, for getting its bearings, for experiencing the structure (extent, position and shape) of space and things. They help the child as an individual to use the world around it, to be active and in this way to satisfy various needs, spot interesting objects etc. Vision is normally the most important source of information about the world already after the first few weeks of life.

Some visual capacity is congenital. In order for vision to develop into a serviceable instrument for the child's experience and daily activities, experience is needed in conjuction with maturity.

How does vision operate practically?

The first task of vision is to provide spatial orientation. When the child grows a little older, this orientation vision furnishes guidance indoors and outdoors and is the foundation of what we term locomotor vision. Another essential task of vision is to supply detailed information about various things: details in the patterns of objects and pictures. This detail vision is, for example, the foundation of reading vision.

Orientation vision and detail vision co-operate in the development process. Orientation vision is conveyed primarily through the peripheral, outer part of the retina, which occupies the large space outside the macula. The vision conveyed in the outer field of vision has quite a low level of

awareness. One is not altogether aware of the visual impressions received in this way. One does not "look" at things in the outer field of vision. This is not to say that they do not produce reactions. One reacts to these visual impressions all the time; during guidance one automatically avoids obstacles without needing to think about doing so or becoming aware of them.

If an object which is interesting or emotionally charged crops up in the peripheral field, the visual impression rapidly surfaces in the awareness and the direction of gaze alters by reflex. The image enters the macula and can be examined. Visual impressions in the peripheral field of vision thus serve the purpose of signalling, so that the conscious gaze can be brought to bear.

(1) It is clear that, in purely practical terms, vision plays a part in the child's general development, it stimulates and governs the child's movements and actions. The child reaches for objects which he sees, crawls or walks to reach them. The child's selection of objects will depend on the emotional implications of what he sees. Even to a newborn, some objects are "more fun" than others. Experience and maturity develop and transform the emotional charges of things.

It is important to point out that the emotional charging of visual impressions plays an important part in steering development. Visual perception must be a positive experience to the child.

(2) Vision is also a means of individual personal development. It serves to make the child independent, active and self-reliant. Through his vision the child perceives space and himself in relation to space and all the things around it. He can find its way about indoors and outdoors, take part in mobile games, ride a bicycle etc. He can get dressed, eat and wash. In all these things it is greatly assisted by vision.

(3) The third practical task of vision is that of conveying visual information in a more limited sense. Vision conveys knowledge about the child's surroundings and his fundamental and visual play of all kinds, viz looking at pictures, games, building, jigsaw puzzles, looking at television and, not least, learning the alphabet and reading.

The practical function of vision is a useful point of departure when appraising a child's vision. The following question can be asked and an attempt made to answer it:

What is the level of the child's vision in terms of practical usefulness?

Does vision play a real part in the child's general development? Is the child's vision sufficient to benefit his personal development and activities? Can vision be used for direct and specialised visual tasks? To how great an extent?

II Visual functions - vision testing

The child uses his vision for practical purposes. The child's visual behaviour expresses his overall visual ability and results from the interaction of several different visual functions: visual acuity is a measure of capacity for distinguishing details, contrast sensitivity is the property which makes it possible to see the difference between the brightness of different surfaces, the field of vision conveys pictures of a large part of one's surroundings, binocular co-ordination provides depth of vision and contributes towards the gauging of distances, darkness adaption enables us to see in poor light, light adaption enables us to accustom our eyes to strong light and avoid being dazzled, colour vision enables us to distinguish between different shades of colour.

The muscular movements (oculo-motor functions) governing the position of the eye and the gaze develop simultaneously and conjointly with the various visual functions. As development proceeds, visual functions and oculomotor functions are interdependent. "Focusing" one's gaze, keeping it still in order to examine something, following an object with one's eyes, "scanning" one's surroundings in search of interesting visual information, adjusting the refraction power of the eye to focus on objects at different distances (accommodation) - all these types of visual behaviour depend on the outward and inward muscles of the eye functioning and being attuned to one another.

Space will not allow me to go into further detail concerning all these visual functions. Instead I refer to the book "Assessment of Vision in Children" (see also page 46). I must, however, touch on the complex conditions which can prevail in children with low vision, for this very reason of vision depending on so many different functions and due to the possibility of those functions being damaged in various ways and to varying extents.

Our commonest vision tests are intended for normally developed children and presuppose normal motor and conceptual development. They proceed directly to measure individual visual functions, above all acuity, binocular co-ordination and field of vision.

Completely different conditions apply to children with impaired vision and children who are retarded or multiply disabled. In these children, it is common for vision disturbance to affect many visual functions and also the oculo-motor skills. Ordinary methods of measurement often yield misleading results or none at all. Other methods are needed instead. Besides, vision testing has to be preceded by preparations and practice. Real success demands the participation of parents, attendants and teachers.

Information about a child's vision can be obtained through:
(1) Objective vision tests and observations of the eyes.
(2) Subjective vision tests.
(3) Behavioural observation.

Objective tests are those in which the child does not participate actively, e.g. tests of the reaction of the pupil to light, electrical responses from the cerebral cortex when vision is simulated, and so on. These tests involve triggering and recording reflexes and electrical phenomena.
Subjective vision tests require active and carefully specified participation by the child. The result will depend to a great extent on the child's ability to understand instructions and perform the task. The child's mental and motor capacity is crucial, for example, when the child is asked to name or point to figures, compare and match pictures, push a button when he sees an object, and so forth.
Below, on page 26, I will briefly summarise the commonest objective and subjective vision tests.

Behavioural observation is less widely used as a basis of vision appraisal. We tend to prefer information which is exact and quantifiable. And indeed it is important for testing methods to be dependable and to yield results which can be compared from one occasion to another and from one child to another.

Turning to the practical purpose of vision testing, we find that perhaps it is not always so very important to be able to quantify the child's visual acuity. Instead we once again ask ourselves:

What is the level of the child's vision in terms of practical usefulness?

Behavioural observation is a very good way of answering this question. It is quite possible to devise routines whereby behavioural observation can provide a measurement of the level of vision which can be recorded and used for purposes of comparison next time we appraise the child's vision in the same way.

There are no hard and fast boundaries between behavioural observation and subjective vision tests. If the visual environment is modified in such a way that behaviour is governed by standardised and graded visual objects, one approaches the principle of subjective testing. The more the child has to take part actively and in a particular way, the more closely the situation will resemble that of a subjective vision test.

In behavioural observation we are concerned with the child's aggregate visual capacity. It is hard to deduce from this the measure of an individual visual function. Since a practical visual task often makes special demands on a certain visual function, one can still obtain measurements of individual visual functions by means of behavioural observation. If the situation is simplified and behavioural observation is combined with registration, this can provide a foundation for very reliable data. Thus preferential looking is employed for exact determination of visual acuity and contrast vision in infants (see the book "Assessment of Vision in Children").

Contrast vision and field of vision are particularly important for spatial orientation and guidance.
The child's ability to cope with detailed visual tasks will depend mostly on visual acuity.
Perception of shapes which are not unduly small, i.e. the most everyday articles in the child's surroundings, does not demand good acuity but does require reasonably good contrast vision.

Vision level - visual sphere

When thinking in practical terms, it is natural to speak of level of vision and visual sphere. I have chosen to grade visual capacity into four levels of vision. These are shown on p. 45 together with examples of the visual tasks which a child can cope with at each level. In the chart I have also tried to indicate the visual acuity roughly corresponding to a certain

level of vision. These relations are only approximate, since a great deal depends on the state of other visual functions and also on the child's general development. The chart is only intended as an aid, not as an exact scale. (p. 45)

By visual sphere I mean how far away the child can see, or rather how far away an object can be and still arouse the child's visual reaction. The visual sphere depends both on visual capacity and interest. Normally the infant has a limited visual sphere; at first it can only see a few decimetres, and soon afterwards half a metre away, and at the age of 1 year it can see things quite a considerable distance away. Between the ages of 2 and 4 and even further up the age scale, one can observe a rapid decline in the child's visual interest when an object is moved 4-5 metres away. Even ordinary vision testing distances (5-6 metres) can make a difference, causing the child to participate badly through lack of interest, and thus yielding misleading test results. Feelings are very important here. The child can see his mother a long way away and runs to meet her, but he does not respond at all when a picture is displayed a few metres away in a test situation.

The visual sphere of mentally retarded children is often reduced due to their inability to mobilise interest, unless there is an emotional contact. Emotional contact usually only occurs if the person or thing is close to the child. Vision impairment also reduces the visual sphere, because the child cannot clearly see objects a long way away.

III Vision tasks and the child

Communication

Vision is a means of communication between the child and other people/the surrounding world. Other senses are also used for communication. A child with impaired vision has to use the sense or "channel of communication" which works best. Conversely, parents and attendants have to find and use this "best" channel as well. This is especially important to start with, when making contact with the child. Once contact has been established through one sense, efforts can be made to arouse the child to contact through other senses as well.

Vision, even if it is low and fragmentary, is extremely important not only for communication but also as a partner for the other senses in the development process. Parents and attendants often realise this very well and try, quite rightly, to elicit a visual response from the child as soon as possible.

Screening off

The aim is to establish contact with the child and to stimulate its development as far as possible. To a great extent this is done by providing the child with enjoyable experiences. This has a great deal to do with success. Exercises of various kinds, daily activity and games are all tasks to be performed. Success in enjoyable and provides an incentive for more activity. Failure is no fun; the child loses interest and becomes passive. This is a great difficulty for all parents and educators. They want to stimulate the child, but the child rejects various suggestive activities and games. It screens itself off in passiveness and self-absorption. This may be partly due to the child's activity never having got started, because its sensory perceptions have been too weak or because too difficult a task has been set. In the case of vision, this means that the visual object has not been capable of stimulating a poorly functioning visual system. In some cases, most often where there is additional handicap involved because of extensive brain damage, screening off leads to the serious condition of autism.

Encouragement and failure in vision

Visual experience in itself is a reward to the child who can be urged into activity, which in turn develops vision. A benign circle is started. The reactions of other people, parents and the attendant are also important. When a child has low vision, the natural thing is to reward him when he can see, when he copes with a visual task. Seeing comes to mean being clever and making mother and father happy. Conversely, of course, not seeing is a failure which means that the child has not been clever and that mother and father are upset. The child feels inferior and does not develop self-confidence. When this happens it may choose not to see. This is one way for the child to avoid failure and protect its self-esteem. The child screens itself off from visual impressions. This is an unfortunate turn of events, and a vicious circle ensues, because the low vision is no longer stimulated at all, it stops short or becomes retrograde. The child can also pretend to see until, one day, the pretence breaks down and he is "caught". This is also a severe blow to the child's ego identity and self-esteem.

So what are parents to do? Here as in all pedagogics, the secret is to activate for success. One must try to make "the fun" part of the actual game, the activity, as opposed to the reactions of other people (e.g. praise). This means keeping games and everyday tasks above the child's vision level. When slightly more difficult tasks are desired, the child should not notice very clearly if he is unsuccessful. Of course, the child will frequently notice all the same that he does not see well, but feelings connected with failure can be toned down. By giving the child tasks of which it is visually capable, one can avoid a day full of disappointments.

(The BUST test, described below on page 34, has been designed to work without too many "can'ts". If one is playing a game with the BUST cards with perhaps a wheel and clock, the child may perhaps fail to distinguish between the two pictures at a certain size, putting a clock together with the wheels or vice versa. This can be tacitly accepted, there will be no disappointments and the game can go on. And yet one has still found out something about the child's vision level. Similarly, the LH test is designed so that, when the pictures become indistinct, all the figures will look like circles to the child, and the child will therefore feel that it can at least see.)

Somewhat different circumstances apply, of course, if the child is blind. The child does not experience failure in the actual matter of seeing. The role of the blind child is more straightforward both to the child himself and to those around him. No impossible visual demands are made. The child may of course be powerfully affected by his parents' dispair, but this is a different psychological problem.

Visual habilitation

By "habilitation" we mean "making skilful". We want our children to become skilful in handling their world, be it a small one or a large one, and whether they themselves have small or large resources. The child must become skilful at his own level and on his own conditions. He does so by actively using his resources. He must be stimulated and developed, he must gain experience and mature.

The best contribution parents and attendants can make is helping the child to think that using his vision is fun.

If this is achieved, development gets going "under its own steam" within the limits of the individual child's potentialities. If this is not achieved, even the best exercise and stimulation programmes will yield a poor return.

The person leading the child's development needs to know about the child's visual circumstances in order to provide the best possible help.

One must be able to appraise a visually handicapped child's vision, not exactly, but so as to identify the child's vision level (cf. page 45). This makes it possible to adapt the visual environment properly, to supply the child with stimulating play materials and to plan and conduct visual habilitation correctly.

The child's vision must be stimulated at the child's current level. This provides the best chance of arousing the child's interest and triggering development. During this process, the child's vision needs to be re-appraised and new vision data have to be incorporated in everyday activities, games and exercises.

In this way, vision appraisal and visual habilitation are intertwined. Preparation for more exact testing of individual visual functions is obtained "into the bargain".

IV Vision appraisal through behavioural observation

The behaviour of a seeing child is based on visual impressions. This is the key to behavioural observation as a basis for appraising visual capacity.

The child is activated by visual impressions and reacts:

(1) The child's interest is aroused, the child becomes attentive.
(2) The child's oculo-motor skills are activated, the child controls its gaze so as to focus on and follow the visual object.
(3) The child focuses on objects and undertakes directive reaching to get hold of something.
(4) The child focuses on objects and crawls or walks towards them.
(5) The child reacts emotionally to visual impressions, smiles at its mother's face, at the doll, at the feeder bottle, at his food, at his clothes, and is upset when mother looks cross or the bottle is removed.

Vision assessment is based on these simple facts. It goes without saying that the child only reacts to and is only activated by visual impressions which it sees. The extent to which a child sees objects will depend on their shape, distinctness, contrast to their surroundings, size and, also, their distance away from the child.

Vision assessment is founded mainly on observations of the child's spontaneous behaviour, but also on observations of the child in a modified environment, when confronted with tasks which the observer has introduced and to some extent controls. One observes, tests, practises, and tests again.

The child's surroundings, play materials and tasks are adapted to its vision level, and after a time a new vision assessment is undertaken, new measures of stimulation are introduced, and so on.

Based on simple observations of the child's spontaneous behaviour in everyday life, elements of "exercise-test-exercise" are introduced into his everyday routine. This can be done at mealtimes, during games, indoors and outdoors, during instruction and at school. Parents, attendants and teachers have very great opportunities of catching the child's attention, steer-

ing his interest and above all utilising his "bright" moments, i.e. moments when the child is balanced and ready for tasks of different kinds.

In order to be able to assess the child's vision by observing his behaviour, one must be able to interpret behaviour in visual terms. One needs to know what vision is needed in order to cope with one or other visual task. Some of these relationships are illustrated in chart 1 (page 45).

It is also important to know about the normal development of visual behaviour, especially during the first year of life, at a low level of maturity. Retarded children sometimes display behaviour belonging to a lower mental age than that corresponding to their biological age.

An infant reacts to light and contrasts between light and dark first of all. In these reactions, behaviour is almost entirely conditioned by reflex and is congenital. Mental experiences soon begin to play a part; emotion, curiosity, lust for activity govern behaviour in relation to various visual stimuli.

Here is a list of everyday behaviour which can easily be observed and which one should try to notice in the child.

The child turns his head towards a window (newborn).
The child focuses on various visual objects and follows them with his gaze. A torch, somebody's face, the bottle (later on), toys.
Visual contact is established with the child. This means that one can observe changes in the child's facial expression indicating that the child can see one's eyes. (4-7 weeks)
The child reacts to his own reflection. He soon also takes an interest in other children.
The child plays with his hands. (3 months)
The child reaches for things.
The child crawls towards things and avoids obstacles in his path.
The child stops while crawling to investigate, visually, small objects in his path; he picks up crumbs and dust, threads etc. (8-9 months)
Towards the end of the first year, visual contact can be used to play "peek-a-boo", which all children enjoy.
The child examines things visually by lifting them to his eyes.

When the child grows older and can move about more freely, particular attention should be paid to the following:

How does the child behave in mobile games, ball games and when cycling?

Can the child imitate gestures and facial expressions?

How does the child cope with differences of level: steps, kerbs?

What about guidance indoors; can the child avoid obstacles?

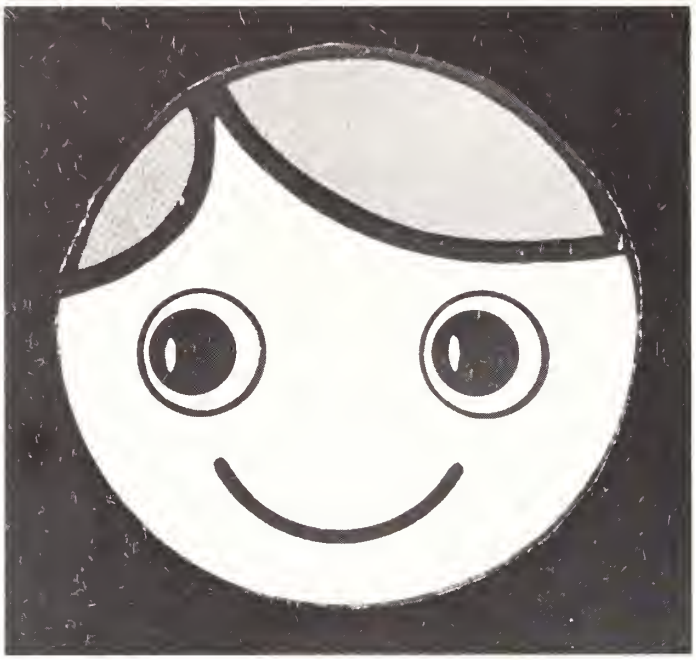
Can the child find his way about outdoors and in traffic?

What about navigation in dimmed lighting?

Does the child usually bend down or crawl closer in order to look at details?

Testing and exercise methods for impaired vision

If impaired vision exists or is suspected, the visual environment can be modified in various ways and the child's behaviour kept under observation.



Ill. 1. Drawing of a face which can be used to test the child's ability to focus. (After Lea Hyvärinen.)

Ill. 2. Easily-seen bottle holders. (After Lea Hyvärinen.)

(1) Lack of visual contact. Go closer, putting your face 10-20 cm in front of the child. Make sure that your face is lit up, so as to make it distinct. Make-up can be an advantage, because it brings out the eyes and mouth. One can also use a picture of a face, with the eyes and mouth sharply drawn. Always make sure that the child is not dazzled and that there are no distracting visual objects behind you (a lamp or a window). The child's visual contact may develop late, and so one should continue working with the child, with one's face at close quarters, frequently and for several months. Visual contact can also be used in order to assess the child's visual sphere. Approach the child from a distance and note the distance at which it makes visual contact. Peek-a-boo is a variant of visual contact which all children get a lot of fun out of. In this way, perhaps, one can capture the child's interest even if visual contact is sluggish. Peek-a-boo is also a good way of appraising the child's distant vision and visual sphere. The same goes for imitative games.

The child's own reflection can be used to arouse visual interest and to stimulate and develop the child's ability to perceive a face and imitate movements. A mirror can be put up close to where the child plays and the child positioned so that he can easily see himself in the mirror.

Ill. 3. Suggested play area arrangement. All of a sudden a child catches sight of himself in the mirror.

Remember that the lighting must be good (i.e. supply adequate light without dazzling) and that the reflection in the mirror will be twice as far away as the mirror itself. The mirror, therefore, should be placed close to the child.

(2) Deficient ability to <u>focus</u> on objects:

A torch at close quarters is a good start. It is also a good idea to use a clearly drawn picture of a face (see ill. 1) or a doll with dark eyes and mouth and a bright face, e.g. a rag-doll. Hold it close and in good lighting to discover whether the child focuses at all. A face is the most interesting thing for an infant or toddler to look at. Stark contrast affords the best stimulus. Other distinct patterns are also good, e.g. LH play material and bottle holders, balls, cubes, beads.

Ill. 5. This is one way of telling instantly how the child focuses on the light, seeing how she directs her hand towards the torch and also checking that the pupils contract when the light enters them.

Notice what size of object the child can see and follow with his gaze. Try to work out the critical distance. Once you have an idea of the vision level which the child is capable of, you can make sure that the child has suitable visual objects closer at hand, i.e. you "diversify" the visual environment and achieve an adapted stimulus. Lilli Nielsen's stimulation material includes quite a lot of material of this kind. For children with poor vision, one should make sure that the visual environment is not too muddled or cluttered. Distinctly shaped toys in dark or bright colours (black, white, red, yellow) are particularly useful at low vision levels. Environmental modification in terms of lighting and colouring is just as important as suitable toys. Shiny tables and floors produce distracting reflections, and so too can shiny toys.

(3) Deficiencies in the development of eye-hand co-ordination:

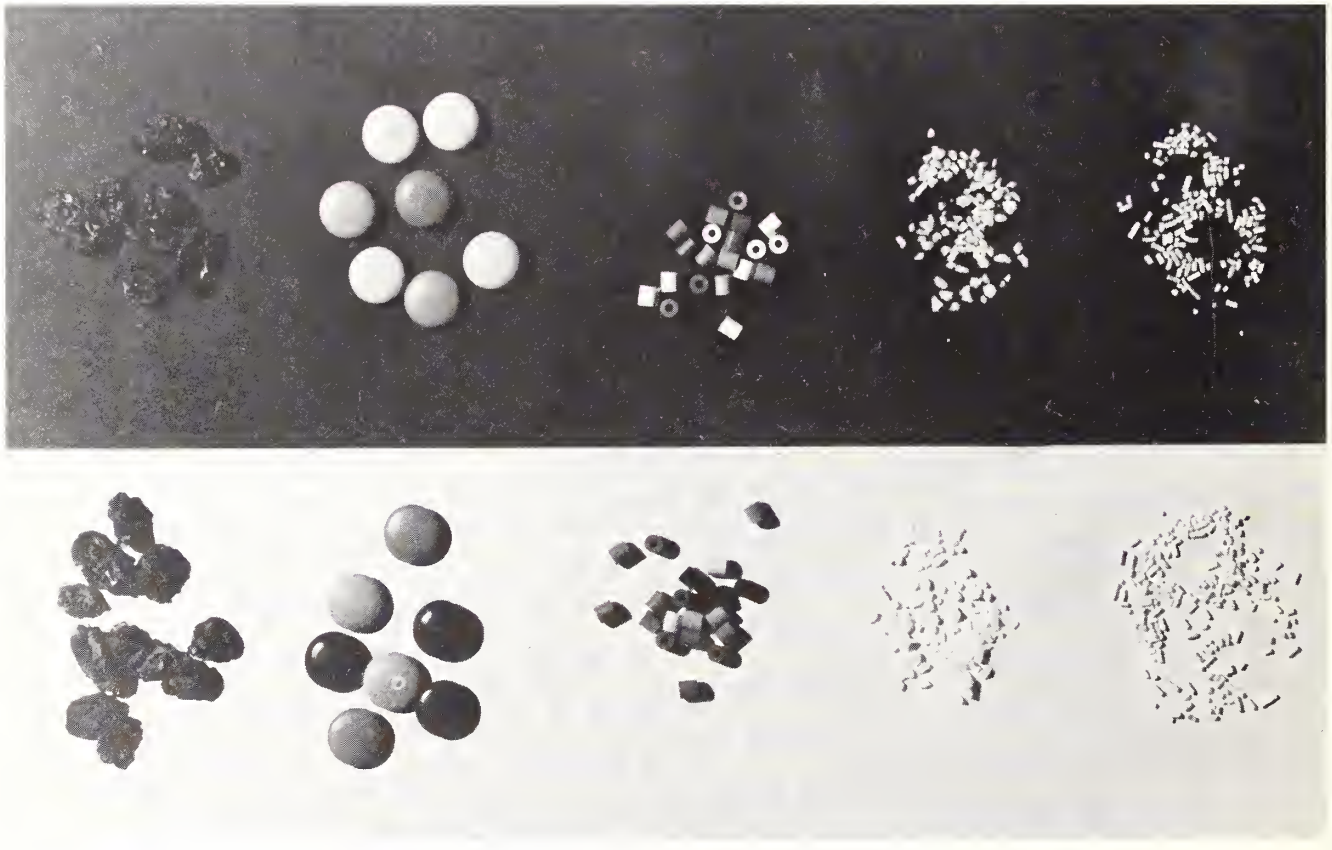
The child does not play normally with his hands. Join the child's hands together in front of his eyes, preferably in good lighting against a dark background. Try in this way to draw the child's attention to his hands. Repeat this manoeuvre frequently.

The child does not reach for things. Place the child on his stomach over your knee or on a stool and put visually suitable objects within reach. Use can be made of LH play material for infants, balls, a musical box, dolls etc. Help the child to grasp things and to move them towards his eyes for examination.

Ill. 5. This position makes it easier for the child to move his arms and hands forward, and objects can be more easily placed within visible range. (After Lillie Nielsen.)

(4) Reduced visual acuity: one notices that the child can see big things but not small ones.

One should start by appraising the level of vision. The child can lie on the floor or sit at a table. Put out differently sized toys for the child to reach for and take hold of. One can also use raisins, flakes, smarties and hundreds-and-thousands. One can vary the underlay (a pale underlay for raisins is easy, a dark one is difficult).
If the child is sufficiently mature, vision assessment can very well be combined with "playing shops".



Ill. 6. Objects for testing near vision: raisins, smarties, beads, nib sugar and hundreds-and-thousands. Different backgrounds serve to vary the visual task.

If the child has difficulty in seeing the objects, try altering the lighting. When size is getting critical, the child will very often show it by crouching or leaning forward. Or again the child may lose interest or start fumbling with its hands and using its sense of touch instead of its eyes. In this case the distance can be reduced by bringing things closer and noticing whether the child is then able to see them. It is a good idea to offer a child a magnifying glass.

Ill. 7. A magnifying glass can be fun to try.

Ill. 8.
Not easy.

Ill. 9.
Is this easier?

Ill. 10. Mirrors can be fun. What a face!

Ill. 11. Visual contact distinct at 1 metre.

(5) Deficient orientation vision: The child bumps into obstacles, baulks at mobile games, misjudges kerbs. In cases of this kind it is important to note whether weak lighting aggravates the problems. Either way, orientation opportunities indoors can be improved by means of better lighting. Good lighting and colouring, producing contrastive effects, facilitate spatial perception and serve to delineate surfaces. This helps children having special problems with their orientation vision and it also helps any other children with poor vision. So environmental modification of this kind is always advisable.
Sometimes, however, strong lighting may cause the child most difficulty. One simple expedient is to eliminate dazzling light sources, e.g. fit blinds to windows, and then see if the child copes better.

(6) Deviating oculo-motor behaviour. The commonest deviation is squinting. Many normally sighted children squint, and this affects their binocular co-operation and also the visual development of the squinting eye. Vision impaired children often squint, but they can also have deviations in the movement pattern of one eye. It is important for the visual function that the child should be able to focus, trace and perform scanning movements. Irregular, rolling movements of the eyes combined with insufficient ability to focus indicate very low vision. First and foremost in this case one must try to develop the ability to focus (see 2, above) and visual contact. Nystagmus is also a common phenomenon which suggests impaired vision, but vision in cases of this kind can vary a great deal. It is useful to note whether the child's nystagmus varies according to the direction in which he is looking. One often sees the child twisting and turning his head, peering, and looking through one corner of his eye. This is a sign that the child has vision and is exerting himself to improve visual conditions by placing his eye in the direction where it will be most stationary. In the case of a child who focuses badly, the onset of this type of behaviour suggests that visual development has got under way. In other words, it is a good sign and must not be counteracted. The feasibility of using aids, however, can be prejudiced by this type of head posture. Measures then may therefore have to be considered for altering the direction of gaze by surgery (to the muscles of the eye) or by means of special glasses. Failing accommodation is difficult to spot. Poorly sighted children "look close", whether they can accommodate or not. Muscular disorders in the eye should always be investigated by an eye specialist.

Ill. 12. What is the picture on the card? The girl tries to bring the picture into her field of vision, searching and peering at different angles.

V. Vision tests described

Objective tests

Objective tests are mostly the doctor's business. They involve observing the outward appearance and inward state of the eyes, their position and spontaneous movements and certain reflexes. They can also involve registration of electrical responses to visual stimulus.

There is a list of the commonest objective tests of visual function.

(1) Appearance of the eyes. Ophthalmoscopy.

(2) Position and spontaneous movements of the eyes: rolling nystagmus, squinting, peering. Direction of gaze, compulsive head posture.

(3) Pupil reflexes: pupil contracts when light enters the eye.

(4) Blinking reflexes: the child blinks when a hand suddenly approaches its eye. For the sake of dependability, this test should be performed with a pane of glass between the hand and the child.

(5) OKN, optokinetic nystagmus. Jerky movements of the eye, nystagmus, can be produced by rotating a black-and-white striped drum in front of the eye, in various directions and at various speeds.

(6) ERG, electroretinogram, i.e. examination of electrical charges in the retina.

(7) VEP, visual evoked potential; electrical responses from the visual cortex of the brain are registered when the eyes are stimulated with various light objects.

(8) Sciascopy, i.e. measuring the refractive ratios of the eye (not a vision test, but an important preparation for one, since it shows what lenses the child may need for the vision test).

Objective tests supply information on certain basic prerequisites of vision, whether the eye can shape pictures, whether the visual system can transmit visual impressions, whether certain reflexes are in working order. VEP also supplies some information about the state of the visual cortex, but not really about actual perception of the visual image.

For further particulars, reference is made to "Assessment of Vision in Children" and "Early Visual Development" (p. 46, notes 1, 5).

Subjective vision tests

Subjective vision tests are inseparable from behavioural observation. Several subjective vision tests involve observing the child's behaviour. Sometimes the case can be used in both ways; one can make do with observing a child's spontaneous reaction to test material, or else one can give the child instructions and ask for particular answers. In some cases the test material can be used to prepare the child for vision tests.

Vision tests are usually performed by professional personnel, viz a GP, a nurse at the child care centre, an ophthoptrist, an assistant ophthalmologist, a remedial teacher or a team. At all events, the persons responsible for preparing the child must be told a certain amount about the tests, the procedure employed and what the tests are designed to measure. There are two reasons for preparing the child. One of them is to give the child general practice in tackling the visual tasks, and the other is to familiarise the child with the concrete objects, picture shapes and procedures occurring in various tests. The child will then be able to recognise the material and will understand what the test situation is all about.

The best vision test results are obtained in the child's accustomed surroundings. But it is seldom possible for vision tests to be performed in the home or at school. This makes it all the more important for the child to be prepared so that, when the vision test takes place at the child care centre/medical reception/paediatric ophthalmological clinic or low vision clinic, the child will at least not be completely unfamiliar with the things used and the situations involved.

An objective examination of the eyes and visual capacity should always precede the subjective vision tests and ought preferably to occur on a separate, previous occasion. It will then be known whether the child needs glasses and vision testing can proceed with proper correction. Attention can then be concentrated on vision testing and there will be no need for any simultaneous examination of the eyes after administration of eye-drops.

Most vision tests are mainly concerned with measuring visual acuity and sometimes the field of vision, and they are less frequently concerned with other visual functions (contrast vision, colour vision). Binocular co-ordination tests are also common, but I shall not be referring to them in this guide.

As stated earlier, subjective vision tests require the participation of mental functions: attention, interest, intellectual operations and, frequently, speech and motor skills.

Demands in these respects vary:

(1) Merely identifying objects or pictures and in some way conveying what is seen (gestures, speech, pointing, fetching etc.).

(2) Identifying and comparing concrete objects or pictures. Understanding same-different, matching, and at the same time pointing to, naming or piling up things which are similar.

The test objects (things, pictures) included in the tests may be 3-dimensional, concrete objects or 2-dimensional pictures depicting concrete objects, or abstract symbols (e.g. a circle, square or triangle).
The picture shapes may be simple, symmetrical, or they may include more difficult elements, e.g. elements requiring the child to distinguish between up and down, left and right (determination of direction), which is a superior mental function.
The tests may present isolated symbols, several symbols in a row (the distance between symbols equalling the width of the symbols themselves) or in close groups (corresponding to the letters of a word).

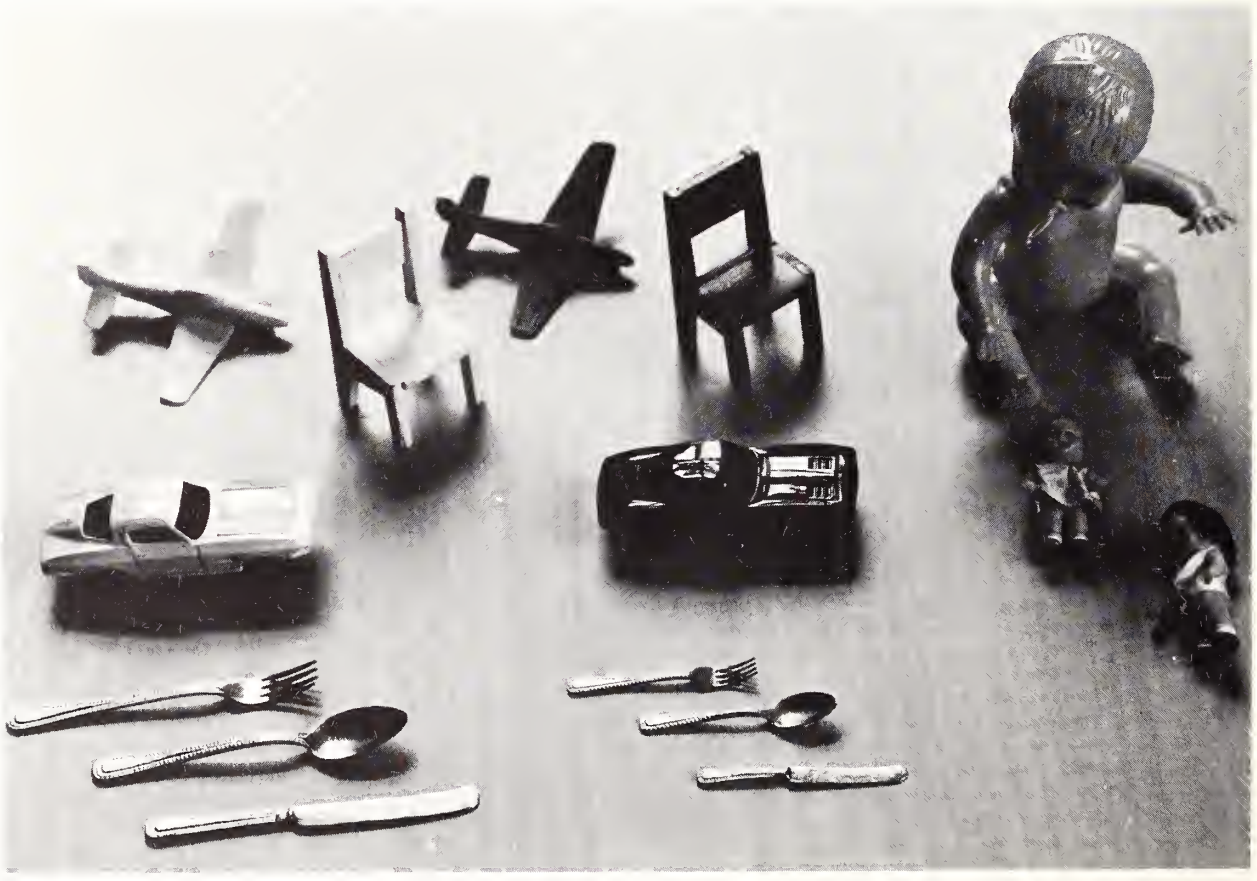
Vision testing also takes place at various distances. Long distance usually means 3-6 metres, close quarters mostly means 25-50 cm. As we have already seen, the child's visual sphere is reduced by low vision and, in certain cases, by retardation. There is nothing to prevent vision tests being performed at a shorter distance than is commonly the practice and the results converted. This is quite easy, because visual acuity is inversely proportional to distance (e.g. the value obtained at half the testing distance is twice as high and therefore has to be halved in order to be correct, see ref. 2, page 46). On the contrary, it is an advantage and very advisable always to begin with shorter testing distances in cases where low vision or a reduced visual sphere is suspected. It is also psychologically preferable to start close to the child, so that he will feel close contact with the person conducting the test. One does not then move further away until, eventually, the child has been encouraged by success. Accordingly, it is best to begin vision testing at close quarters and to save more long-range testing until later. Start with a test at close quarters (10-15 cm) and, if this turns out well, change to the distance for which the test is designed (e.g. 25 cm). In long-range tests, start at 0.5-1 metre, gradually increasing the distance if the child answers confidently. Measurement at a distance of 3 metres is frequently sufficient.

Lighting is important in all vision testing. It is equally important when making preparations for tests. Valuable information can also be obtained by testing vision in different lighting conditions, but this is seldom actually done. When making preparations for vision testing, one can observe whether the results vary a great deal with the lighting.

1. The STYCAR test

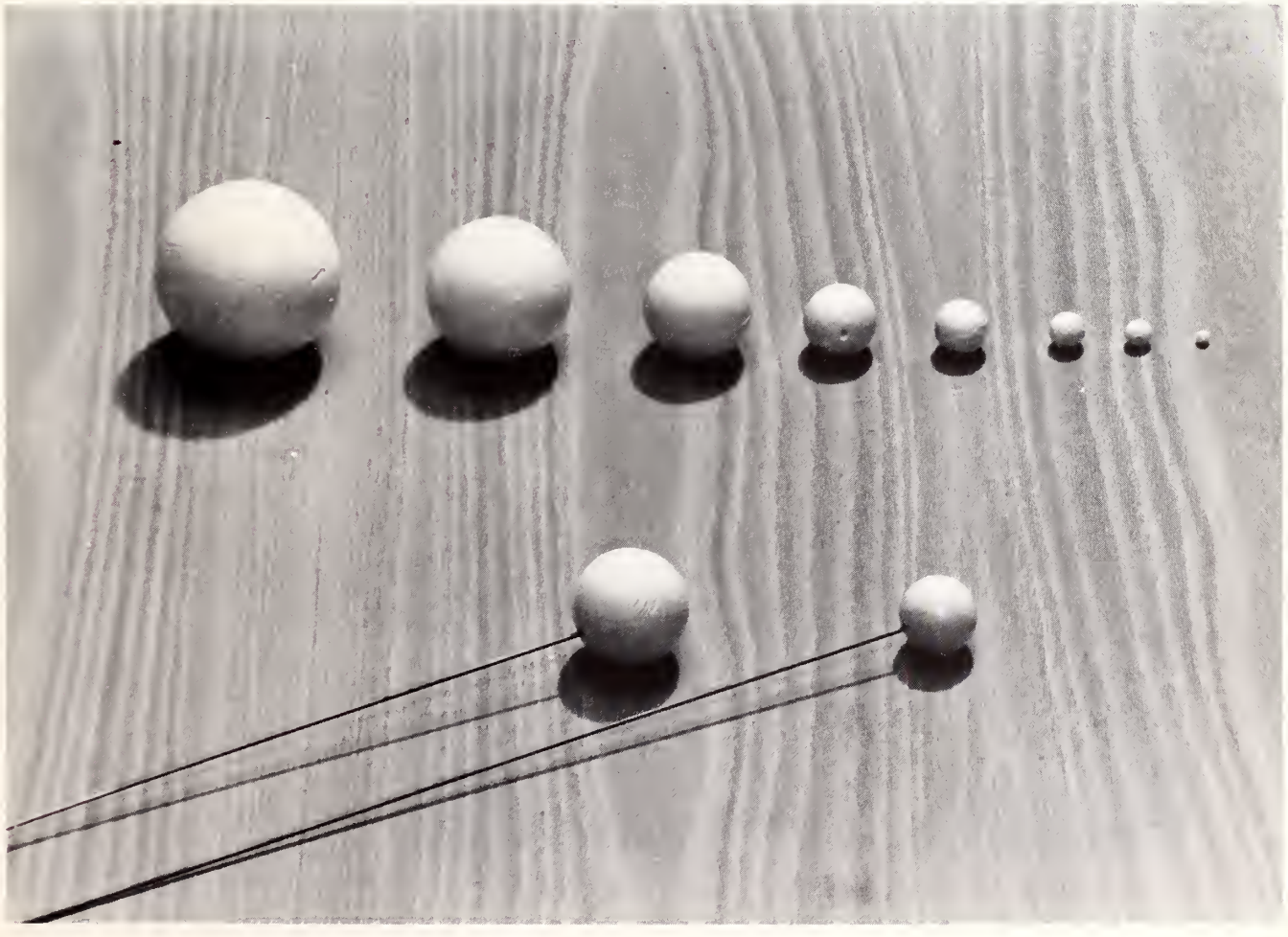
This name is an abbreviation of "Sheridan's Test for Young Children and Retardates" and comprises a series of tests devised by Mary Sheridan which supply information about the child's perception of shape, its visual acuity (to some extent) and its field of vision. The test should be conducted by a professional team, and the team should be supplied with an exhaustive guide. (Page 46)

(a) Sheridan's toy test is used at long range. It includes a series of fairly large and small toys respectively which the child can be asked to identify or to match with similar objects (doll, car, aeroplane, spoon, fork). The fork and spoon can be used for roughly gauging visual acuity. They have to be kept against a dark background. The large toys can be seen by a child at vision level 1 (see page 45), while the smaller ones require vision level 2 and ability to distinguish between fork and spoon at 4-5 metres suggest a vision level of 3-4. This test makes a good introduction to other tests and is a useful means of arousing interest.



Ill. 13. The STYCAR toy test

(b) Sheridan's ball test provides a rough indication of the child's vision level, visual sphere and field of vision and, to a lesser extent, his visual acuity. To be really useful, this test has to be conducted by personnel who are familiar with it. It is used in two different procedures: a test with rolling balls and a test with a ball fitted to a rod. Rolling balls require a big room, cushions on the floor, black cloth which can be draped on the wall and spread out on the floor. The lighting has to be controllable. Differently sized white balls are rolled on the floor on a black underlay. The child sits on a cushion on the floor. The distance to the path followed by the balls can be 1.5-6 metres, but it ought not to exceed 3 metres. Two people roll the balls to each other and observe the child's behaviour. It is a very good idea to make a game out of the ball test. The child is asked to sit still on the cushion until the ball has stopped, and then he can crawl or walk up to the ball, collect it and put it in a bucket. While the child is sitting still one can observe when he begins to see the ball, because his gaze fastens on it and then follows it until it has stopped. There are cases of the child not seeing the ball until it has stopped.



Ill. 14. Sheridan's ball test

Ball on a rod. A dark screen can be used in this test, which is performed at various distances. Somebody stands behind the screen and moves white balls, secured to a rod, from various positions at the sides of the screen towards its centre. Here again one observes when the child first notices the ball, i.e. focuses on it and follows its movement inwards. Another version is to stand behind the child and move the balls forward from various directions. This test provides some indication of the child's field of vision but requires quite a lot of co-operation from the child.

Ill. 15. Ball test, using a ball secured to a rod. The child is occupied with something, but the occupation must not be too enjoyable and absorbing.

The ball test can be used from a mental age of 6-8 months. It can often supply good information about the child's level of vision. Low vision or pronounced retardation can make it hard to capture the child's interest with balls, which are not particularly amusing unless the child can cope with the game of "fetching the ball".

(c) Sheridan's letter test also forms part of the Stycar series. This includes white plastic letters of the alphabet which are symmetrical in shape (A, H, O etc.), so that the child will not have to judge directions (right-left). There is also a match card showing various numbers of these letters (5, 7 or 9 per card). The long-range and close-range test cards display individual printed letters which have to be matched with plastic letters or letters on a match card. The child can point to a letter or name it. Thus the test does not require the child to recognise the letters, only to identify the shape of the symbol and point to a similar shape.

Mention can also be made at this point of Sheridan-Gardiner's test, which represents a further development of Sheridan's letter test. In addition to a test card and match card, this test also includes a series of books of test letters to be used in vision testing at long and close range.

Sheridan's PANDA test is modified for low vision. The test cards here consist of black card shapes with test letters in raised white plastic.

BUST

BUST is the name of a new test for children at early mental ages and is a combined test of form perception and visual acuity. It is designed in such a way that the demands on the child's understanding of the image can be varied, and also the demands made on its visual acuity. The test can be used as a game, played with in various ways and, finally, used for directly testing visual acuity. BUST consists of picture cards in playing card form. There are two series of different standards of difficulty. Each series has four figures. The first is pictorially easy to understand and recognise, comprising as it does a cup, flower, wheel and clock. The second series is a little more difficult: glasses, scissors, spoon and fork. These pictures are supplemented by a series of LH symbols: a ring, a square, an apple and a house (see also below). Each picture is reproduced on a match card and the corresponding concrete objects also have to be available (series 1-2).

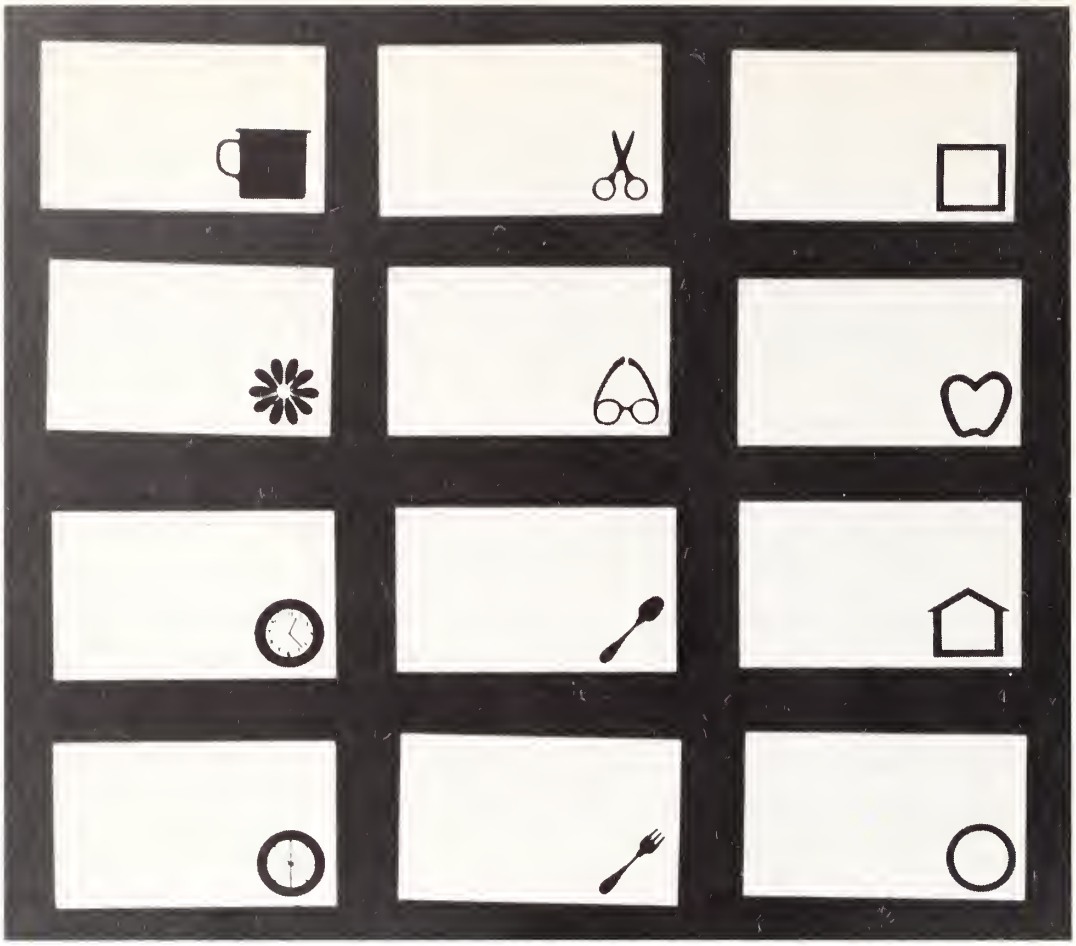
Very simple identifications can be performed with the picture cards by merely including a couple of very different figures. This makes it easy for the child to match object and picture. Things can be made more difficult by letting the child choose between pictures which are quite similar (scissors-glasses, wheel-clock) and more difficult still by including many figures in the game. The more abstract LH pictures are for a further step in development.

Ability to distinguish between spoon and fork depends on visual acuity, and the test result tallies closely with other visual acuity test data. Tests using the LH pictures provide the safest indication of visual acuity.

The cards are designed in such a way that the person leading the game can see from the back of them which series each card belongs to and the size of its symbol. The pictures come in 9 sizes. The idea is for the largest of them, with a little practice, to be visible at vision level 1. (See page 46, ref. 2.) A table for use in interpreting the results is supplied together with the test material.

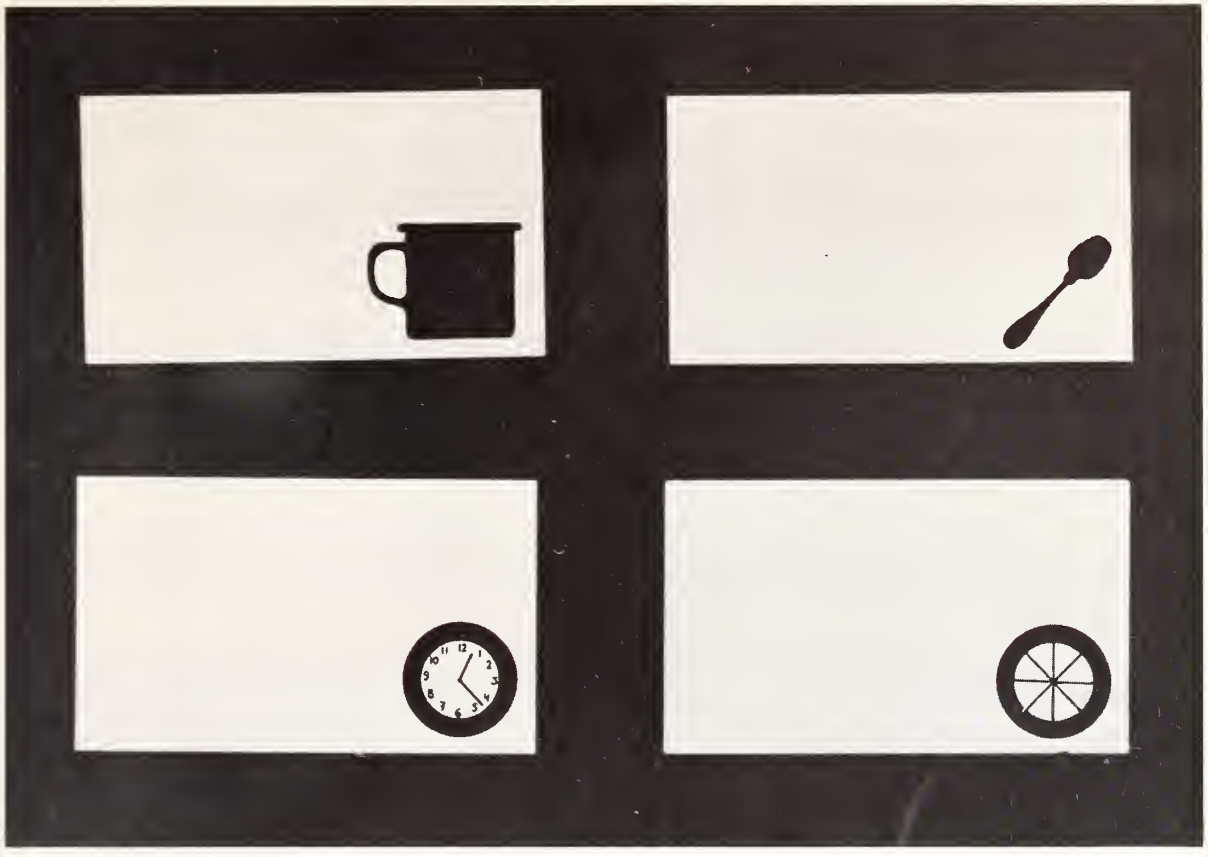
BUST has been tested for some years by eye specialists, educationalists and psychologists. It works well with children whose mental age is between 1½ and 7 years. It provides a new opportunity when children are "difficult to test", for example on account of low vision, retardation and also hearing impairment, because the figures are easily translated into sign language.

The game can be played with parents, attendants and children and at various levels of difficulty. In this way the child can be made familiar with the figures and can learn to compare and match pictures.

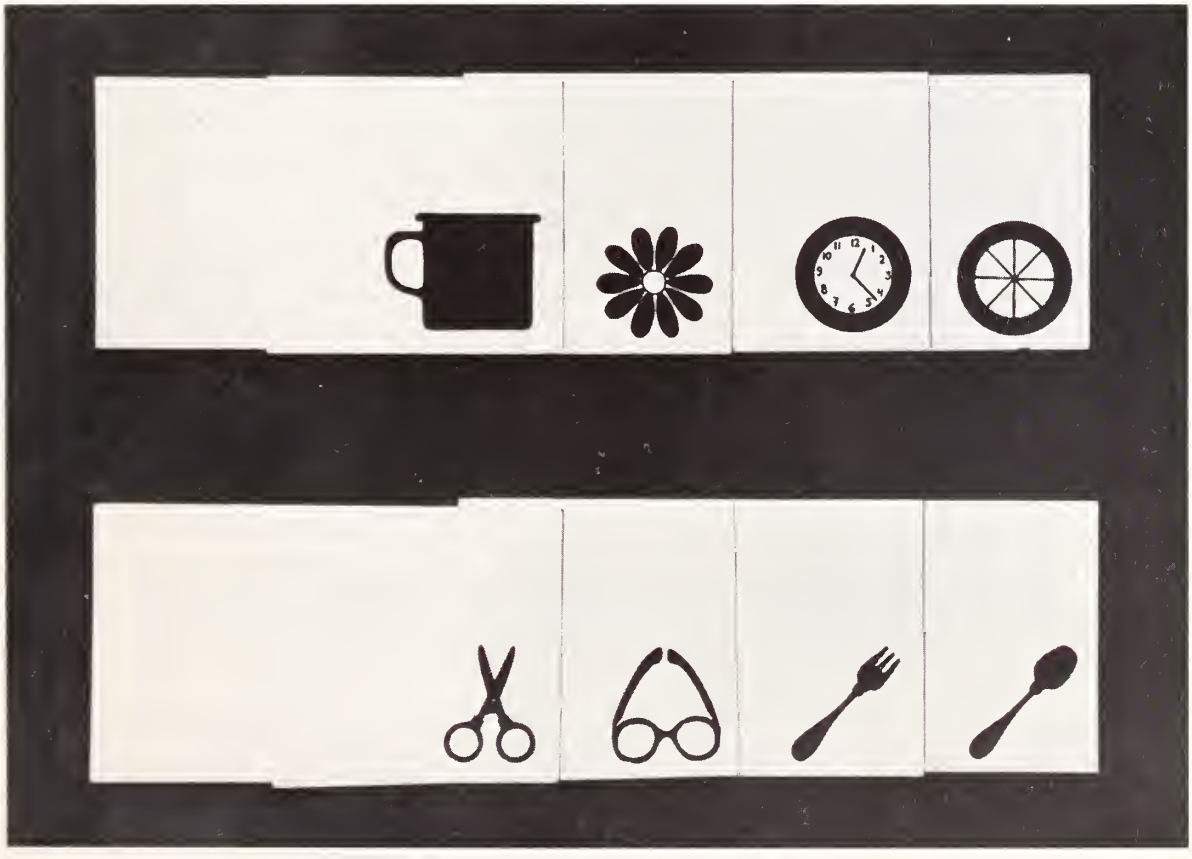


Ill. 16. The BUST symbols: series 1 (left) and series 2 (centre). Right: the LH symbols.

Ill. 17. Objects used in the BUST test.



Ill. 18. The BUST test. Two very different figures (top) are easily distinguished, but it takes more effort and a certain visual acuity to distinguish between the clock and the wheel.

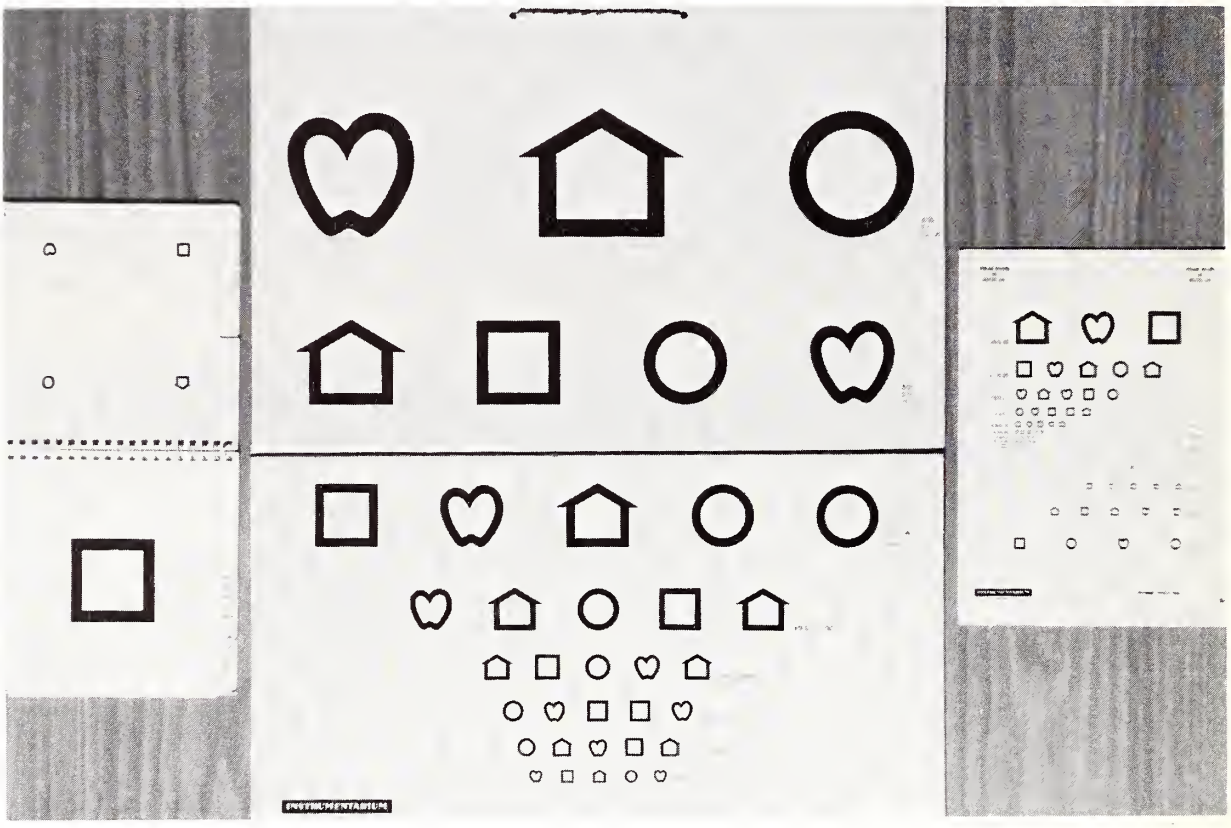


Ill. 19. The BUST symbols arranged as a line test.

3. The LH test

The LH test is used for both long-range and close-range tests. There are long-range test cards and close-range test series showing the LH symbols individually, in lines and in close groups (resembling the sequence of letters in a word). There is a match card for the child to point if he has difficulty in naming the symbols.

The LH test has been designed with the fact in mind that form perception as well as visual acuity plays a part in testing. The test has been standardised by comparison with E tests and it produces very dependable results. It can be used from age 3 years, and given practice it can also be used at earlier ages.



Ill. 20. Left and centre: LH tests. Individual symbols and line tests for long-range use.

Right: LH close-up tests; single symbols and line tests. On the other side of the card, the symbols are displayed in a group.

The symbols are shaped in such a way that correct perception of the picture will depend on visual acuity. If acuity is poor, the child will see the sybmol in all four cases as a ring; the distinctive features of the symbols - the corners of the square, the indentations of the apple, the pitched roof of the house - fade first, leaving the impression of a round figure.

The LH symbols are also available as LH-playing cards, see above, and in LH-DOMINO. This is an ordinary game of dominoes with differently sized LH symbols on the pieces. This game is intended both for practice and for testing. During the game it is important to simply observe, not to react negatively, when the child sees things wrong. This game can also be used for practice with a magnifying glass.

4. The illiterate E

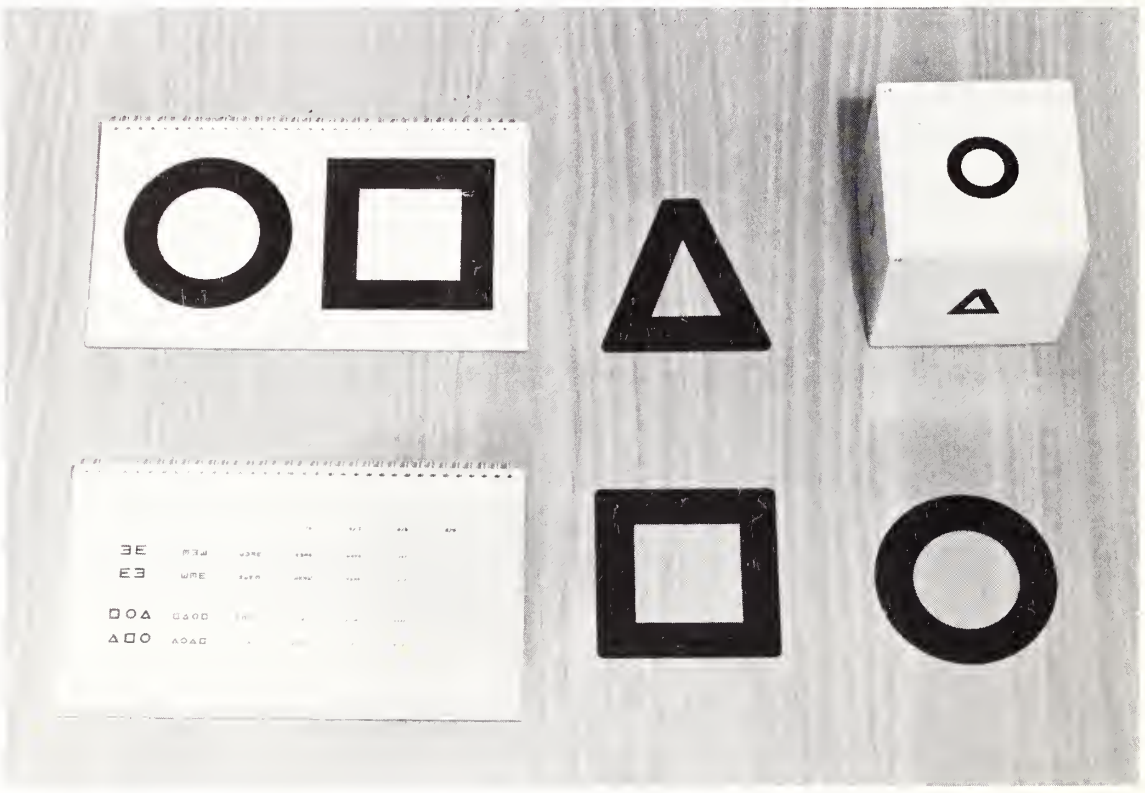
The illiterate E is a test which is frequently used, for example, in screening the visual capacity of all 4-year-olds. It provides a very reliable indication of visual acuity, since one really has to see the serration of the E in order to determine the direction in which the prongs of the E are pointing. This is quite difficult, however, because the child has to be able to perceive and distinguish between up and down and right and left. Even normally developed children can find this difficult when they are 4 years old. Retarded children seldom manage this test, at all events not without practice. Vision impaired children may also have perceptual disturbances, which makes it hard for them to cope with spatial and directional determination.

The illiterate E is used mostly for testing visual acuity at long range. Test cards with an individual E symbol or E symbols in a row are shown at a distance of 5-6 metres. There is nothing to prevent the testing distance from being reduced and the result adjusted accordingly. The match symbol is an E-shaped wooden rake. The child can also be asked to indicate the position of the E-prongs manually, which makes the test a little easier. Some children are distracted and find it difficult to turn and rotate the illiterate E. The illiterate E is also included in Ffooks' near vision test.

Landholt's rings (a ring with a gap turned in various directions) are a similar test).

5. Ffooks' test

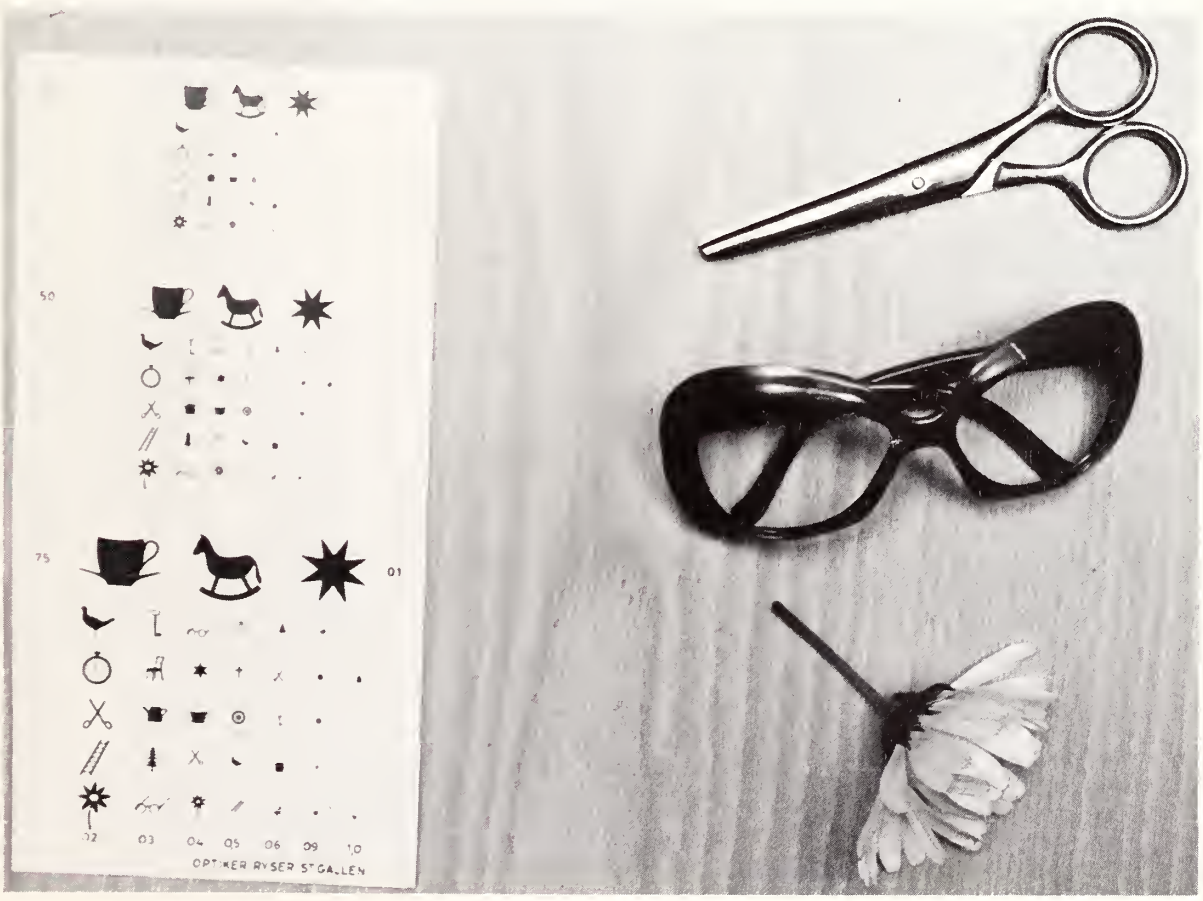
Ffooks' test is also a symbol test, for both long-range and close-range testing. It consists of the symbols of a circle, a square and a triangle, the illiterate E and alphabetical tests. Ffooks' symbols are printed individually in black on a white cube, in various sizes on the sides of the cube (there are two different cubes). They are also printed on test cards bound together with test cards for close-range use. The match symbols are of black plastic and should be placed on a bright surface. This test can often identify the vision level of children who are difficult to test by other methods. The reliability of the test is quite low, since it is too easy to distinguish the triangle and the other symbols by their shape alone, without any need for good visual acuity. Ffooks' near vision test includes both E symbols in close groups, Ffooks' symbols and letters of the alphabet. This is a very handy test to have available and is very suitable for rough testing of the child's level of vision.



Ill. 21. Ffooks' symbol test. The book on the left contains both long-range and short-range tests. The near vision test contains the Ffooks symbols, the illiterate E and letters of the alphabet, all displayed in groups.

6. Figure charts

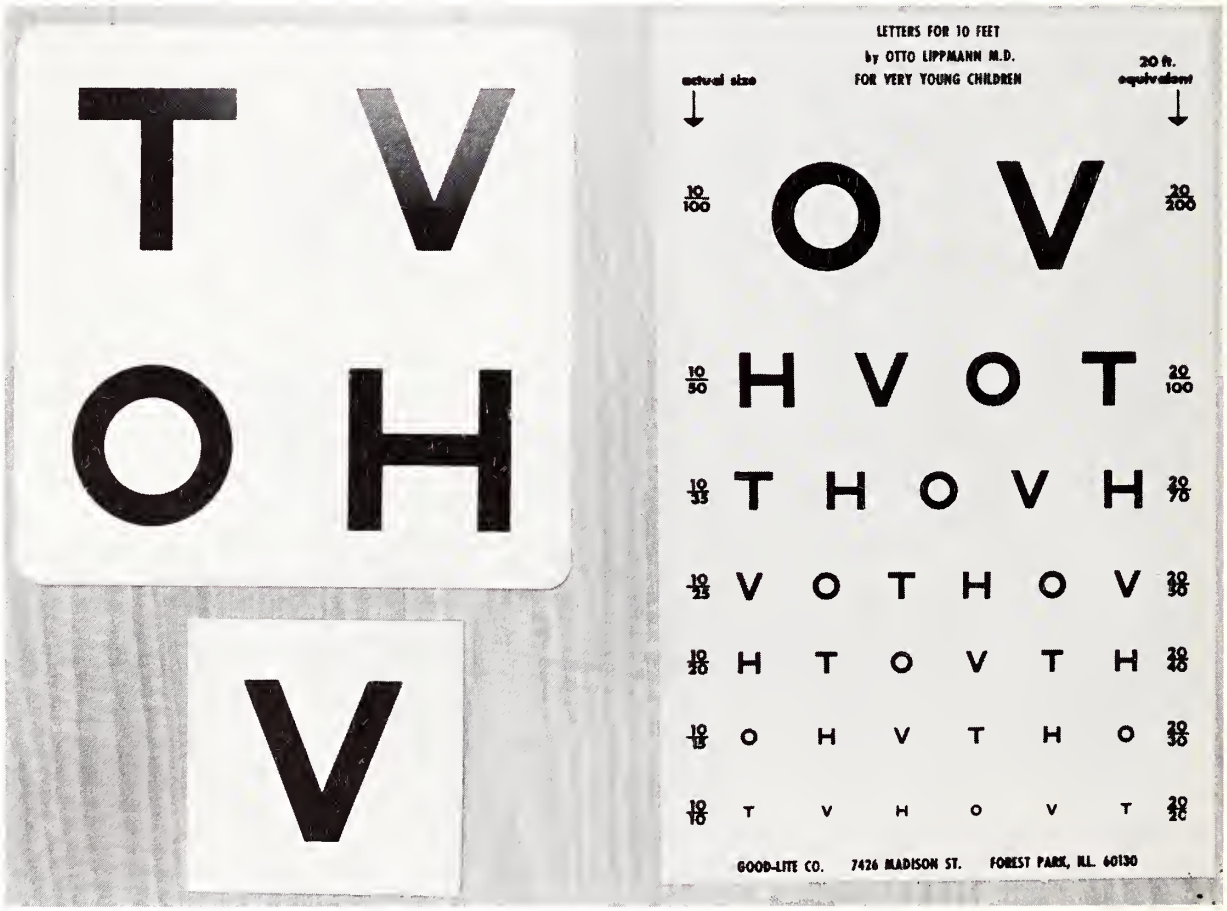
There are various types of figure charts depicting objects. Their disadvantage is that they are unreliable if the pictures are realistic. If they are stylised the child often cannot understand what they are meant to depict. The biggest disadvantage, especially in the case of retarded children, is that the charts contain so many figures. These children almost invariably find it difficult to cope with many pictures at a time. Consequently, picture charts are seldom a success. They can be tried occasionally, if it is difficult to get the child interested in other tests. Österberg's chart is used to some extent in Sweden. There is also a Danish test which has acquired some currency, and an American test (Lighthouse). Ryser's picture test can be used at close quarters and made more interesting by presenting real objects for matching.



Ill. 22. Ryser's picture test can be combined with real objects.

7. Letter charts

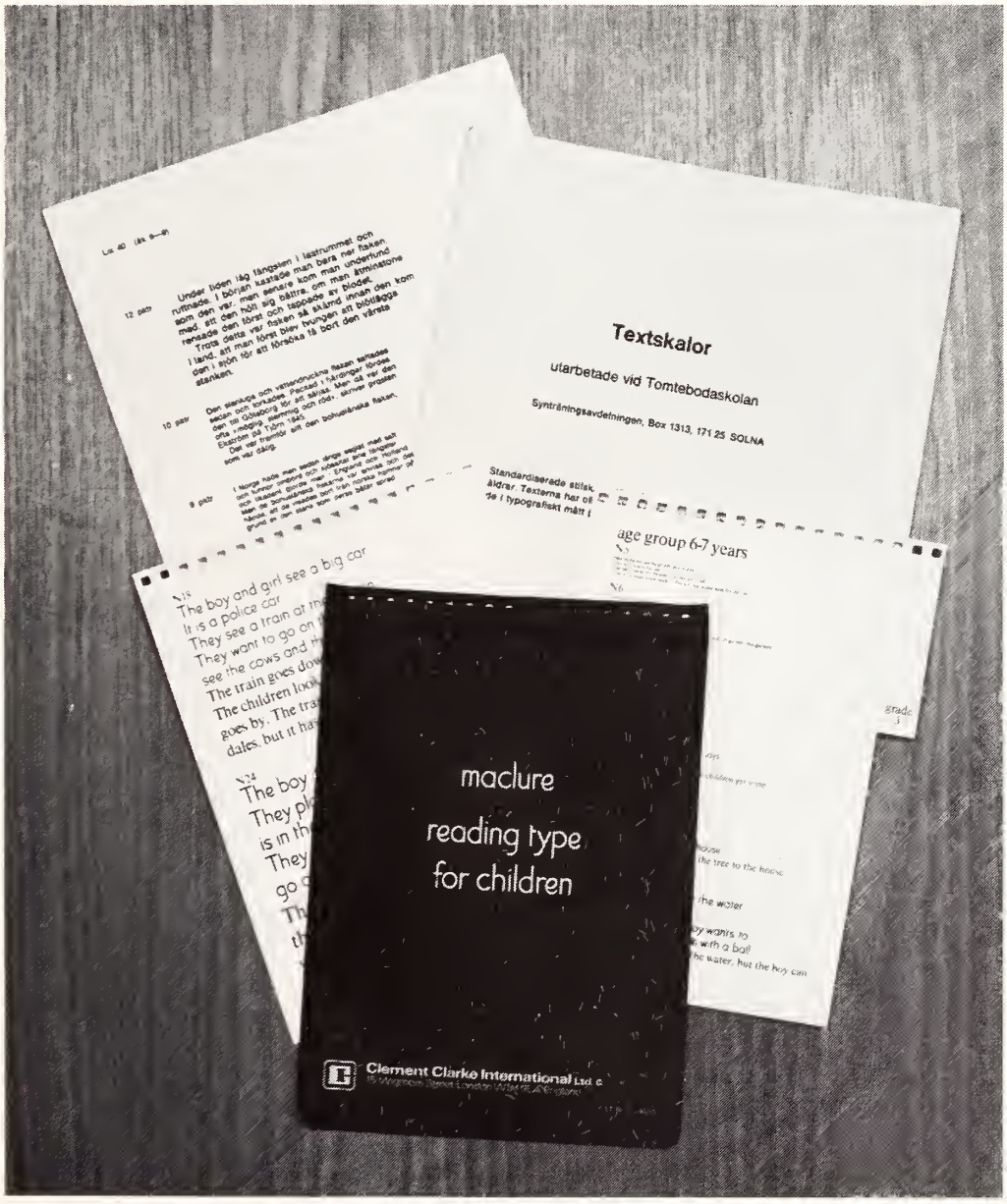
Ordinary letter charts are known to everybody, and I shall not consider them here, beyond observing that the testing distance can very well be reduced when using them. Things can be made easier by screening off the letters, e.g. using a cardboard mask with a window to isolate a line or half a line, thus reducing the number of letters displayed simultaneously. There are also projectors which display only one or a few letters at a time. Individual letters occur in the Sheridan-Gardiner test cards. The HVT chart contains only a few letters and is standardised for a reading distance of 3 metres.



Ill. 23. The HVT chart and match cards. The chart is used at a distance of 3 metres.

8. Reading charts, reading passages

It is also important to test visual acuity with reading charts at close quarters and by means of reading passages. Here again, the technique and texts have to be modified when dealing with vision impaired children. On this subject, reference is made to the T-scale, obtainable from RPH-SYN, Solna. English equivalents include, for example, the Maclure reading types for children (Clement Clarke, Ltd., London).



Ill. 24. The T-scale, Tomteboda typographical test scales, and Maclure Reading Types for Children.

Multiple disabilities

Most vision testing methods are based on the child using his hearing, motor skills and speech faculty in the test situation. Consequently, children with multiple disabilities are difficult to test.

Speech problems. If the child has no speech, a test can be used in which one points at things instead of naming them. The child can also be allowed to answer by making various gestures. In cases of this kind, behavioural observation is important, and in this way information is obtained about the child's vision without the child having to speak.

Deafness - hearing impairment is a difficult problem in the testing situation. Even if one knows a certain amount of sign language, help is still needed in communicating with the child, primarily in order to explain visual games and tests properly. Behavioural observation has its appointed place and can yield good results, especially if the child has a fairly high level of vision, so that he will be activated by visual objects.

Severe motor disabilities are quite frequent. This poses a serious problem when appraising vision, because the child is unable to show, by turning his head or reaching towards a visual object, that he can see things. Nor is he able to point in ordinary vision tests. It is not uncommon for these children also to lack speech, in which case there can be no question of their expressing verbally what they can see either. All that remains is to read off the child's emotional utterances when confronted by visual objects. If the oculo-motor skills function, the child's vision can be assessed by means of his ability to focus on objects and follow them with his gaze.

CHART

Level of vision	Visual achievement	Visual sphere	Approximate visual acuity	Remarks
I	Recognising people and faces at close quarters. Big toys, dolls, soft toys, balls, tableware, feeder bottle, cutlery, furniture, clothing. Locomotor vision, differences of level difficult. Ball games usually impossible	0.5-1.5 metres	0.01-0.05	Possible with peripheral vision without firm focusing, given reasonably good contrast vision.
II	Small toys. Marbles and balls. Jigsaws, large pictures. Card games. Lego. Raisins, flakes, smarties. Locomotor vision quite good. Ball games may be doubtful. Cycling often possible. With visual tasks at close quarters, "close-peering" behaviour.	3-4 metres	0.05-0.1	Some focusing capacity necessary.
III	Very small toys and objects. Assembly kits. Details of pictures, wooden beads. Needlework (large stitches). Hundreds-and-thousands, crumbs. Letters of the alphabet, figures (not small print). "Close-peering" behaviour. Can't see car registration numbers at a distance. Sits close to the TV, has some trouble seeing the blackboard at school.	Quite good, but no details at a distance.	0.15-0.3	Focusing capacity and accommodation necessary. Impairment not very noticeable before school age if vision is otherwise normal (1)
IV	Reads ordinary test at normal working distance. Watches TV and can see the blackboard.	Not noticeably reduced	More than 0.3	There may still be vision impairment if contrast vision is reduced or there are great oculo-motor problems. (1)

(1) Severe restrictions of the field of vision affect visual achievement at all levels of vision. Bad night vision or adaption problems also have an affect.

References

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BUST-LH playing cards: MANUAL. Stockholm 1985 5.
(ELISYN, Eva Lindstedt, Högbergsg. 30, S-116 20 STOCKHOLM, Sweden.)

3. Nielsen Lillie: The comprehending hand. National Board of Social Welfare, Copenhagen 1979.

4. Sheridan MD: Manual for the Stycar Vision Test. NFER Publishing Co., Windsor, 1976.

5. Hyvärinen L and Lindstadt E (eds.). Early Visual Development - normal and abnormal.
Acta Ophthal, suppl. 147, 1983.

Note.

Most of the tests mentioned in this book are available through:
Clement Clarke Ltd., 15 Wigmore Street, LONDON W1H 9L. England.

The Stycar set through: N.F.E.R. Publishing Co., WINDSOR, England.

The BUST and LH-playing cards through: ELISYN, Eva Lindstedt, Högbergsgatan 30, S-116 20 STOCKHOLM, Sweden.

The LH tests through: Vistest, Lea Hyvärinen, Harmaapaarankuja 3, SF-02200 ESPOO, Finland.

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